

IN THE SPECIFICATION

On the cover sheet, please delete the title "PROTOCOL MASTER COMMUNICATIONS  
5 IN AN INTELLIGENT ELECTRONIC DEVICE" and replace it with the following:  
--METHOD AND SYSTEM FOR MASTER SLAVE PROTOCOL COMMUNICATION IN  
AN INTELLIGENT ELECTRONIC DEVICE--

On Page 1, at line 1, please delete the title "PROTOCOL MASTER COMMUNICATIONS  
10 IN AN INTELLIGENT ELECTRONIC DEVICE" and replace it with the following:  
--METHOD AND SYSTEM FOR MASTER SLAVE PROTOCOL COMMUNICATION IN  
AN INTELLIGENT ELECTRONIC DEVICE--

Please amend the following paragraphs:

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[0001] This application is a continuation-in-part under 37 C.F.R. § 1.53(b) of U.S. Pat.  
Application Ser. No. 09/723,564, entitled "INTRA-DEVICE COMMUNICATIONS  
ARCHITECTURE FOR MANAGING ELECTRICAL POWER DISTRIBUTION AND  
CONSUMPTION", filed November 28, 2000 (Attorney Docket No. 6270/48) now U.S. Pat.  
X2 20 No. \_\_\_\_\_, the entire disclosure of which is hereby incorporated by reference. U.S.  
Pat. Application Ser. No. 09/723,564 filed November 28, 2000 (Attorney Docket No.  
6270/48) now U.S. Pat. No. \_\_\_\_\_ is a continuation-in-part under 37 C.F.R. § 1.53(b)  
of U.S. Pat. Application Ser. No. 08/798,723 filed February 12, 1997 (Attorney Docket No.  
6270/9), abandoned, which is a continuation-in-part under 37 C.F.R. § 1.53(b) of U.S. Pat.  
25 Application Ser. No. 08/369,849 filed December 30, 1994 (Attorney Docket No. 6270/6)  
now U.S. Pat. No. 5,650,936.

X3 30 [0005] Accordingly, ~~is it~~ it is an object of the present invention to provide a system that  
overcomes the disadvantages of the prior art by integrating and consolidating the operations,  
communications and interactions of an electrical distribution system comprising a  
heterogeneous suite of inter-networked electrical metering devices as well as slave devices

AB and loads, including legacy devices, for the purposes of protection, control and/or metering of electricity.

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5 [0033] IED's can also be created from existing/legacy electromechanical meters or solid-state devices by the addition of a monitoring and control device which converts the mechanical output, such as the rotation of the rotary counter, or pulse output into electrical pulses/digital data..data. An exemplary electromechanical meter is the AB1 Meter manufactured by ABB in Raleigh, North Carolina. Such conversion devices are known in the art. Herein, legacy refers to devices or platforms inherited from technology earlier than the current technology.

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AS [0049] Figure 1a illustrates a block diagram of a Modbus RTU Packet. The Modbus data packet 100 includes an ADDRESS field 104, a ~~FUNCTION~~ FUNCTION code field 106, a DATA field 108 and a cyclic redundancy check ("CRC") field 112. The ADDRESS field 104 contains either two characters (Modbus ASCII) or eight bits (Modbus RTU). An assigned slave device address is in the range of 1-247 decimal. A master addresses a slave by placing the slave address in the field of the message. When a slave responds it places its own address in the address field to let the master know which slave is responding.

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AB 20 [0058] Referring back to the figures, Figure 2 illustrates a system overview of the preferred embodiment while Figure 3 illustrates a flow diagram of how the master device makes data available to the client application. Figure 2 shows an exemplary IED 200 having master/slave communication capabilities. The IED 200 is coupled with a load/power system 201 for the purpose of monitoring and/or control. Further, the IED 200 is coupled with a slave device 235 via a closed/proprietary ~~network/protocol~~ network protocol 209 such as 25 ION or Modbus RTU. The slave device 235 is further coupled with a load for the purpose of monitoring and/or control. The IED 200 is also coupled with an open/non-proprietary network 207 such as the Internet for the purpose of communicating with remote devices and/or applications 220. The IED master/slave device 200 further contains device ~~circuitry 210~~ circuitry 210 and a server module 230. The device circuitry 210 will be 30 described in detail later. The server module 230 contains communications capability and

web server capability, and interacts with internal hardware and/or software, such as software applications, in the device circuitry 210. It will be appreciated that there may be more than one server module 230 supporting one or more of the TCP/IP based networking protocols described above. The circuitry 210 connects with a slave device 235 over a closed network 209, which communicates using a proprietary or closed master/slave protocol such as ION or Modbus RTU. It will be appreciated that there may be more than one circuitry 210 for connecting with more than one slave device 235 or the circuitry 210 may be capable of connecting with more than one slave device 235. The server module 230 connects with a client application 220, such as a web browser, over an open network 207, which communicates using an open non-proprietary protocol such as HTTP. It will be appreciated that the server module 230 may also have the capability to connect with the slave device 235, depending on the circuitry 210 configuration.

[0059] Referring to Figure 3, in operation the slave device 235 monitors or collects data from the load 240. The master/slave device 200 requests data from the slave device 235 over the closed protocol network 209 (block 300). The slave device collects the data (block 305), such as ~~my monitoring~~ monitoring or measurement, etc., and sends the requested data to the master/slave device 200 over the closed protocol network 209 (block 310) using a first protocol. The data is received by the device circuitry 210, which includes a processor (not shown) which is further configured to process both data from the load/power system 201 and incoming data from slave devices (block 315). Upon receipt of the data, a function is performed on the data (block 320). This function may include, for example, a power management function, and will be explained in detail later on. The master/slave device 200 then converts the processed data into an open non-proprietary protocol (block 330), ~~commonly referred~~ commonly referred to as open protocols to one skilled in the art, such as HTTP. The data is then passed to the server module 230 where the server makes the new data available (block 340), for viewing, retrieval or transmission. A client application 220, such as a web browser, can then view the data over an open protocol network 207 from the server module 230 (block 350). For example, the server module 230 may receive a request from the client application 220 to view the aggregated usage data from load 201 and load 240. The server module 230 receives and processes the request. If the data is available, the

server module 230 serves it to the client application 220 via the network 207. If the data is not available, the server module 230 passes the request to the device circuitry 210. The device circuitry 210 then requests the current usage data for load 240 from the slave device 235 using the closed network 209. The slave device then responds with the requested data.

5 The device circuitry 210 also obtains the usage data for load 201. The usage data for load 240 and 201 is then aggregated and the combined usage data is passed back to the server module 230 which then serves it to the client application 220.

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**[0065]** Figure 4b illustrates a third embodiment of an IED 400 for use in a power management or control architecture. It will be appreciated that the IED 400 contains the device circuitry 405 as shown in Figure 4a, but with additional components, as will be described later. The IED 400 is preferably coupled with a load 401 via a power distribution system 410, or portion thereof. The IED 400 includes device circuitry 405 and is further coupled with a network 407. A device, such as a computer, executing a web/HTML browser program 420, such as Internet Explorer™ is also attached to the network 407. In the preferred embodiment the web browser 420 is located on a computer, such as a personal computer having at least 32 MB memory and 1 GB hard disk with a Pentium™ or equivalent processor or better, executing the Microsoft Windows 98™ operating system and Microsoft Explorer™ or equivalent.

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**[0073]** Figure 7 illustrates an alternate embodiment where a master device is coupled with several smaller networks, each network having its own protocol. In this embodiment the communication module on the master device 700 facilitates two way communications between the non-proprietary client application 740 and the slave device 705 710 715 720. For example, the first network 725 communicates between devices 705 710 using a Modbus protocol and the second network 730 communicates between devices 715 720 using the ION protocol. The master device 700 communication circuitry is coupled with the slave devices 705 710 715 720 on either network 725 730, thereby allowing the master device 700 to send, receive or respond to data or commands sent from the slave devices. As described earlier the device circuitry converts and processes the data or commands from the proprietary protocol such as the Modbus protocol or the ION protocol, to a third common

*As  
control* Internet network open protocol, such as HTTP. The master device's 700 web server allows the viewing device 700 to view the data over the network 735. It will be appreciated by one skilled in the art that the data or command communication between slave devices 705 710 715, the master device 735 and the viewing device 740 can be bi-directional.

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